



# Improved Biomass Stoves

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# A Pragmatic First Step

## HEALTH | SAFETY



- Slight improvement in Indoor Air Pollution?
- Safe to use, no habit change required in cooking or fuel collection practices.
- Option to use a variety of biomass based fuels – firewood, crop waste, dry dung, more processed biomass formats

## ENVIRONMENT | EFFICIENCY



- Fuel consumption can go down by up to 70%, 1-3 tonnes of GHG emissions avoided per family per annum?
- Tier II and Tier III models
- Portable, Long Lasting designs

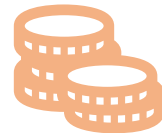
## AFFORDABILITY | AVAILABILITY | CONVENIENCE



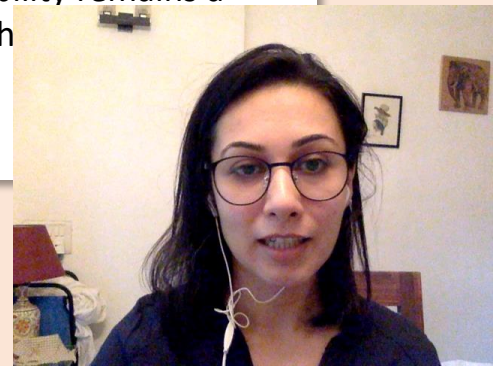
**TIME SAVING** - Fuel collection time/effort is reduced to half.  
Cooking time is reduced due to faster kindling/startup.

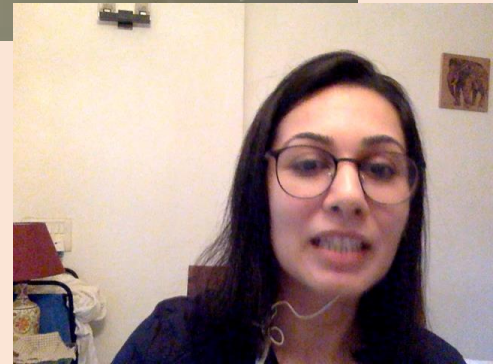


**AVAILABILITY** – Fuel is always available and generally free. Households pre-stock for hot summers and monsoons.



**AFFORDABILITY** - Typically under \$40, no spend on fuel, even so, affordability remains a big challenge due to low househ





Wood



carbonisation



Charcoal



densification  
of charcoal  
residues +  
binder



Agri-processing or forestry  
residues



drying,  
carbonisation,  
densification



Char briquettes



drying, densification



Pellets



Biomass briquettes



carbonisation



Charcoal briquettes



# Fuel characteristics and user considerations



## HEALTH | SAFETY



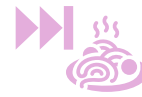
- Charcoal and char/charcoal briquettes emit mainly CO
- Biomass briquettes also emit smoke & PM, at least in most HH stoves
- Pellets usually clean burning due to gasification
- Other user risks are similar to those from any solid fuel stoves (burns, spillage, etc)
- All these fuels are commercially traded and purchased, so no significant procurement risks

## ENVIRONMENT | EFFICIENCY



- Briquettes and pellets usually made from residues and wastes
- Environmental impacts of charcoal hotly debated; generally linked to forest degradation, rather than deforestation
- Charcoal & char/charcoal briquettes have high efficiency potential in modern stoves
- Biomass briquettes difficult to use efficiently in most HH stoves
- Pellets are highly efficient in correct stoves, esp. with fan

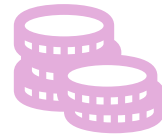
## AFFORDABILITY | AVAILABILITY | CONVENIENCE



- Char briquettes usually fragile; high breakage rate and dust residue
- Briquettes take longer to light than woodfuels, and need special techniques
- Slower to heat up and lower peak temp.
- Not usually good for grilling
- Only charcoal can be extinguished and re-used



- Charcoal ubiquitous – anytime, anywhere!
- Sourcing briquettes and pellets can be challenging – needs new distribution systems (costly)
- Seasonal supply limitations if using crop residues



- Char briquettes can be price-competitive with charcoal in urban areas
- Others briquettes and pellets cost more
- Higher price unlikely to be recouped from fuel savings, so adoption may need subsidy



# LPG is safe, clean and convenient relative to other fuels

## HEALTH | SAFETY



- LPG is the only stove whose emissions are below the critical level of  $10\mu\text{g}$  per  $\text{m}^3$ . In contrast to LPG, biomass burning typically releases 19 times more emissions per meal
- Injuries from burns and even explosions can be caused by factors including poorly maintained equipment and unsafe filling
- Training users to safely use and store LPG is essential

## ENVIRONMENT | EFFICIENCY



- LPG is a clean-burning fuel that produces fewer  $\text{CO}_2$  emissions compared to biomass, fuel oil and, in many countries, electricity.
- LPG emits virtually no particulates, thus switching to LPG has an impact on levels of black carbon, microscopic airborne particles which some experts rank as the second biggest contributor to climate change after  $\text{CO}_2$

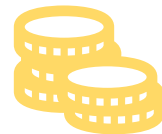
## AFFORDABILITY | AVAILABILITY | CONVENIENCE



LPG can be turned on and off at will making cooking quicker and more efficient compared to most other fuels.

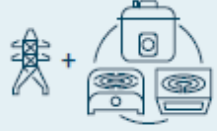





Where it is available it can be purchased at retail points, which are more likely to be in urban areas



In many places, including Kenya and Tanzania, cooking with LPG is cheaper than using charcoal and kerosene, though the cost of buying a full cylinder and prohibitive for many families.



USE OF BATTERY	GRID OR MINI GRID	SOLAR HOME SYSTEM
Without battery	<b>Strong grid</b> AC grid eCooking 	<b>Off-grid</b> DC solar eCooking 
Battery-supported	<b>Weak grid</b> DC grid battery-powered eCooking 	<b>Off-grid</b> DC solar battery-powered eCooking 



# Electric cooking (eCooking)

The Kenya Power & Lighting Company Plc.   
 @KenyaPower

Did you know electric pressure cookers help in preparing foods faster than other cooking methods?

Use smarter cooking techniques as they are safer, cheaper, save time and energy.



Kenya Power and Energy and Petroleum Regulatory Authority

10:45 AM · Sep 13, 2021 · Twitter Web App

7 Retweets · 1 Quote Tweet · 11 Likes



# Electric cooking (eCooking)



## HEALTH | SAFETY



- Zero kitchen emissions
- Insulated appliances (e.g. rice cookers) mitigate risk of burns. Electric Pressure Cookers (EPCs) have many automated safety & control mechanisms to ensure pot cannot be opened when pressurized.
- No need to leave the house to collect or refill fuel

## ENVIRONMENT | EFFICIENCY



- Environmental impact depends on electricity generation mix and if applicable, battery storage technology.
- Tier 5, 70-90% thermal efficiency
- Additional energy savings from insulation, pressurization & automatic control

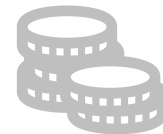
## AFFORDABILITY | AVAILABILITY | CONVENIENCE



- No fuel collection
- No stove preparation
- Automatic controls enable multi-tasking
- Pressurization reduces boiling time



- Reliable grid connection: 24h 365 days/yr
- Unreliable grid connection: Blackouts & brownouts can limit ability to cook, but energy storage can mitigate
- Off-grid: SHS offers most power on sunny days



- Inefficient appliances (e.g. hotplate): moderate upfront cost, high running cost.
- Efficient appliances (e.g. EPC): high upfront cost, low running cost
- Service-based delivery models needed

Story By  
Design /  
CLASP



ATEC

### PAYGO Enabled



ATEC® developed and patented the world's first PAYGO-tech for induction stoves. PAYGO enables users to pay the system off in company installments using mobile money as they use the system (and generate savings) rather than taking out additional loans or have to pay in full with cash.



"PAYGO allowed me to access this new technology. Our family is safer and healthier now."

Kim Phatthanasri (pawlo.co)

ATEC®



# Find out more:

- [MECS.org.uk](https://MECS.org.uk)
- [Cooking with Electricity – A Cost Perspective](#)



# Biogas impact

## Health | Safety



- **No indoor air pollution** (clean and renewable biogas)
- **Low risk of indoor toxicity** for H<sub>2</sub>S production (Filters + ventilation)

## Environment | Efficiency



### Impact on the environment



- Reduces deforestation – **SDG 15**
- Reduces poor waste management and protect water bodies – **SDG14**
- Reduces GHG emission – **SDG13**
- Increases access to clean energy – **SDG7**

#### Efficiency

- ISO certified cookstove with top tier rating (efficiency, durability, safety, emissions)
- 1m<sup>3</sup> biogas ≈ 1.5h cooking ≈ 1.3 kg firewood

#### Add-ons

- Biogas appliances (culturally adapted cookstoves, biogas industrial burners, engines, etc )

## Affordability | Availability | Convenience



### How convenient is the usage of biogas?

- **Easy to use**, no need to collect or buy any fuel outside the homestead
- No need for any cookstove preparation
- Only **10-20 min/day** of digester maintenance



### What needs to be said about biogas availability?

- Ideally for **rural homes** with livestock and/or animals
- Biogas is **available 24/7** if the system is fed with manure every day or 2-3 times per week
- Ideal for temperate and warm climates with water availability



### Affordability

- 10% deposit and savings from day 1: monthly payments are less than the savings from reduced fuel costs
- Up to 35% of household income saved on fuel costs





# Ethanol stoves and fuels technology impact

## HEALTH | SAFETY



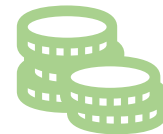
- Significantly reduce HAP and provide a number of health benefits.
- 400 times cleaner in terms of PM2.5 and emits 13 times CO than three-stone fire.
- Ethanol stoves are extremely safe.
- They are non-pressurized and spill-proof.
- Ethanol is miscible in and easily extinguishable by water.
- Fuel handling and storage
- Denature ethanol

## ENVIRONMENT | EFFICIENCY



- Ethanol have a positive impact on environment.
- Nontoxic and biodegradable
- Avoid deforestation
- GHG Emission Reduction
- thermal efficiency - 60+ %,
- heat power of 1.75 kW
- tier 4 (the top tier) in all metrics
- No add-on needed improves efficiency

## AFFORDABILITY | AVAILABILITY | CONVENIENCE



- the stove are easy to operate and use.
- turns on immediately, with no time or struggle required to ignite.
- the heat can be regulated easily
- Cook fast
- Ethanol fuel is produced and available locally in most countries.
- ethanol has a convenient and efficient supply chain.
- Supply little affected by seasonal variation
- Require infrastructure to reach rural households

Stove: Different design of the stoves to meet needs

- Available from \$23 – local assembly and subsidy from carbon finance to reduce the cost

Fuel : Compete with charcoal, kerosene and LPG

- E.g Ethiopia: cheaper compared to kerosene and LPG; it is more expensive than wood and electricity.

